

20. (New) The method, as recited in claim 1, wherein the stripping away the etch mask and removing some residual sidewall passivation, simultaneously strips away the etch mask and removes the residual sidewall passivation.

REMARKS

Claims 1-20 are pending in the present application. Claim 17 has been amended and claims 19 and 20 have been added.

The applicant would like to thank the Examiner for her time during the telephone conference of October 3, 2002. The telephone conference allowed the applicant to better understand the Examiner's reasons for rejection in this office action.

The Examiner rejected claims 1-5, 15, 17, and 18 under 35 U.S.C. § 102 as being anticipated by Hsieh et al. (US 5,776,832).

Hsieh does not teach the step of stripping away the etch mask and removing some residual sidewall passivation, while the substrate is in the etch chamber, as recited in claims 1 and 15. Column 3, lines 19-24, and column 6, lines 35 to 41, state that the oxygen ashing step strips photoresist and builds up sidewall passivation. The applicant agrees that the ashing step of Hsieh strips photoresist but Hsieh does not remove some sidewall passivation, but instead adds more sidewall passivation. Nothing in Hsieh discloses removing sidewall passivation, while the substrate is in the etch chamber.

For these reasons, Hsieh does not teach a step of stripping away the etch mask and removing some residual sidewall passivation, as recited in claims 1 and 15. For these reasons, claims 1 and 15 are not anticipated by Hsieh.

Claim 2 is dependent on claim 1, and further recites the step of electrostatically attracting plasma from the etch mask stripping gas to the substrate in the etch chamber. Table I of Hsieh indicates that during the ashing step (step 3) the DC bias is 0 volts. Therefore Hsieh does not teach electrostatically attracting plasma from the etch mask stripping gas. For at least these reasons, claim 2 is not anticipated by Hsieh.

Claim 3 is dependent on claim 2 and for this reason is not anticipated by Hsieh.

Claim 4 is dependent on claim 3 and further recites that the step of stripping away the etch mask and removing residual sidewall passivation further removes residue from walls of the etch chamber. The Examiner did not cite anything in Hsieh that teaches removing residues from walls of the etch chamber. For at least these reasons, claim 4 is not anticipated by Hsieh.

Claim 5 is dependent on claim 4 and for this reason is not anticipated by Hsieh.

Claim 17 is dependent on claim 1 and further recites that the stripping away removes parts of the metal-containing layer that are redeposited. The Examiner cited nothing in Hsieh that discloses removing parts of the metal-containing layer that are redeposited. For at least these reasons, claim 17 is not anticipated by Hsieh.

Claim 18 is dependent on claim 1, and further recites that the stripping away comprises accelerating oxygen plasma to the substrate to remove parts of the metal containing layer that are redeposited to form residual sidewall passivation. As discussed above, Hsieh does not teach using a bias to accelerate during ashing and that parts of the metal containing layer are removed. For at least these reasons, claim 18 is not anticipated by Hsieh.

The Examiner rejected claims 6 and 7 under 35 U.S.C. § 103 as being unpatentable over Hsieh as applied to claim 1 above, and further in view of Fukuyama et al.

Claim 6 is ultimately dependent on claim 5 and further recites placing the substrate in a load lock and removing the substrate from the load lock to place the substrate in the etch chamber. For at least these reasons, claim 6 not made obvious by Hsieh in view of Fukuyama.

Claim 7 is ultimately dependent on claim 6 and further recites placing the substrate in a corrosion passivation chamber after the substrate has been removed from the etch chamber and exposing the wafer to a non-plasma high temperature water vapor. Since Hsieh teaches passivating the chlorine in the etch chamber (col. 3, lines 19-21), Hsieh would teach away from subsequently putting the substrate in a passivation chamber after removing the substrate from the etch chamber. For at least these reasons, claim 7 is not made obvious by Hsieh in view of Fukuyama.

The Examiner rejected claims 8-14 under 35 U.S.C. § 103 as being unpatentable over Hsieh as applied to claim 1 above, and further in view of Fukuyama et al. and further in view of Tepman et al. (US 5,186,718).

Claims 8-14 each depend either directly or indirectly from claims 1-7, and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claims 1-7. Additionally, these dependent claims require additional elements that when taken in the context of the claimed invention, further patentably distinguish the art of record. For example, claims 11 and 14 recite that the step of electrostatically attracting plasma from the etch mask stripping gas comprises the step of biasing the chuck supporting the substrate to the bias power between -10 and $-1,000$ volts. Hsieh teaches that during the ashing step there is no bias. For at least these reasons, claims 8-14 are not made obvious by Hsieh in view of Fukuyama and in further view of Tepman.

Claim 19 has been added. Claim 19 is dependent on claim 1 and further recites that the stripping away the etch mask and removing some sidewall passivation comprises removing metal containing parts of the metal-containing layer that are redeposited to form residual sidewall passivation. None of the references discloses or makes obvious removing metal containing parts of the metal containing layer that are redeposited to form residual sidewall passivation in the etch chamber.

Claim 17 has been amended and claim 20 has been added to more clearly state that the stripping the etch mask and removing sidewall passivation are simultaneous.

The applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at (831) 655-2300.

If any fees are due in connection with the filing of this Amendment, the Commissioner is authorized to deduct such fees from the undersigned's Deposit Account No. 50-0388 (Order No. LAM1P133).

Respectfully submitted,

BEYER WEAVER & THOMAS, LLP



Michael Lee

Reg. No. 31,846

P.O. Box 778
Berkeley, CA 94704-0778
(831) 655-2300

CLEAN VERSION OF PENDING CLAIMS

1. A method for etching at least partially through a metal-containing layer disposed above a substrate, wherein part of said metal-containing layer is disposed below an etch mask and part of said metal-containing layer is not disposed below the etch mask, comprising the steps of:

placing the substrate in an etch chamber;

flowing an etchant gas into the etch chamber;

creating a plasma from the etchant gas in the etch chamber;

etching away parts of the metal-containing layer not disposed below the etch mask, wherein some of the etched away parts of the metal-containing layer is redeposited to form residual sidewall passivation while the substrate is in the etch chamber;

discontinuing the flow of the etchant gas into the etch chamber;

flowing an etch mask stripping gas into the etch chamber;

creating a plasma from the etch mask stripping gas in the etch chamber;

stripping away the etch mask and removing some residual sidewall passivation, while the substrate is in the etch chamber; and

removing the substrate from the etch chamber.

2. The method, as recited in claim 1, further comprising the steps of:

electrostatically attracting the plasma from the etchant gas to the substrate in the etch chamber; and

electrostatically attracting the plasma from the etch mask stripping gas to the substrate in the etch chamber.

3. The method, as recited in claim 2, wherein the etch chamber is a metal etch chamber.

4. The method, as recited in claim 3, wherein the step of stripping away the etch mask and removing residual sidewall passivation further removes residue from walls of the etch chamber.

5. The method, as recited in claim 4, wherein the etch mask stripping gas comprises oxygen.

6. The method, as recited in claim 5, further comprising the steps of:

placing the substrate in a load lock; and

removing the substrate from the load lock to place the substrate into the etch chamber.

7. The method, as recited in claim 6, further comprising the steps of:

placing the substrate into a corrosion passivation chamber after the substrate has been removed from the etch chamber; and

exposing the wafer to a non-plasma high temperature water vapor.

8. The method, as recited in claim 7, further comprising the steps of:

transferring the substrate from the corrosion passivation chamber to a cooling station;

cooling the substrate in the cooling station; and

transferring the substrate from the cooling station to the load lock.

9. The method, as recited in claim 8, further comprising the step of maintaining a pressure between 1 and 80 millitorr during the etching and stripping steps.

10. The method, as recited in claim 9, further comprising the step of maintaining the substrate at a temperature between 10° and 100° C during the etching and stripping steps.

11. The method, as recited in claim 10, wherein the step of electrostatically attracting the plasma from the etchant gas comprises the step of biasing a chuck supporting the substrate to a bias power between -10 and -1,000 volts, and wherein the step of electrostatically attracting the plasma from the etch mask stripping gas comprises the step of biasing the chuck supporting the substrate to a bias power between -10 and -1,000 volts.

12. The method, as recited in claim 4, further comprising the step of maintaining a pressure between 1 and 80 millitorr during the etching and stripping steps.

13. The method, as recited in claim 12, further comprising the step of maintaining the substrate at a temperature between 10° and 100° C during the etching and stripping steps.

14. The method, as recited in claim 13, wherein the step of electrostatically attracting the plasma from the etchant gas comprises the step of biasing a chuck supporting the substrate to a bias power between -10 and -1,000 volts and wherein the step of electrostatically attracting the plasma from the etch mask stripping gas comprises the step of biasing the chuck supporting the substrate to a bias power between -10 and -1,000 volts.

15. A method for etching at least partially through a metal-containing layer disposed above a substrate, wherein part of said metal-containing layer is disposed below an etch mask and part of said metal-containing layer is not disposed below the etch mask, comprising the steps of:

placing the substrate in the etch chamber;

etching away parts of the metal-containing layer not disposed below the etch mask, wherein some of the etched away parts of the metal-containing layer is redeposited to form residual sidewall passivation on the substrate, while the substrate is in the etch chamber;

stripping away the etch mask and removing some sidewall passivation while the substrate is in the etch chamber; and

removing the substrate from the etch chamber.

16. An apparatus for etching at least partially through a metal-containing layer disposed above a substrate, wherein part of said metal-containing layer is disposed below an etch mask and part of said metal-containing layer is not disposed below the etch mask, comprising:

means for placing the substrate in an etch chamber;

means for flowing an etchant gas into the etch chamber;

means for creating a plasma from the etchant gas in the etch chamber;

means for etching away parts of the metal-containing layer not disposed below the etch mask, wherein some of the etched away parts of the metal-containing layer are redeposited to form residual sidewall passivation while the substrate is in the etch chamber;

means for discontinuing the flow of the etchant gas into the etch chamber;

means for flowing an etch mask stripping gas into the etch chamber;

means for creating a plasma from the etch mask stripping gas in the etch chamber;

means for stripping away the etch mask and removing some residual sidewall passivation, while the substrate is in the etch chamber; and

means for removing the substrate from the etch chamber.

b1 17. (Once Amended) The method, as recited in claim 1, wherein the stripping away the etch mask and removing some residual sidewall passivation, simultaneously strips away the etch mask and removes parts of the metal-containing layer that are redeposited to form residual sidewall passivation.

18. The method, as recited in claim 1, wherein the stripping away comprises accelerating oxygen plasma to the substrate to remove parts of the metal-containing layer that are redeposited to form residual sidewall passivation.

19. The method, as recited in claim 1, wherein the stripping away the etch mask and removing some sidewall passivation comprises removing metal containing parts of the metal-containing layer that are redeposited to form residual sidewall passivation.

b2 20. The method, as recited in claim 1, wherein the stripping away the etch mask and removing some residual sidewall passivation, simultaneously strips away the etch mask and removes the residual sidewall passivation.
